RESPONSE SUMMARY

Air Quality Control Permit No. 1000383
for
Yarnell Mining Company

This Class I, unitary permit is issued to the Yarnell Mining Company (YMC), a subsidiary of Bema Gold (U.S.), Inc. (permittee) for the development and operation of an open-pit, gold mining operation. The Yarnell project site is situated one-half mile south of the town of Yarnell and one-quarter mile southeast of the Glen Ilah subdivision, as measured from the northwest boundary of the proposed project area to the southern boundaries of Glen Ilah and Yarnell. The proposed project will consist of the open-pit mine, two waste rock areas, ore crushers, a heap leach pad, process ponds, an assay laboratory and a gold refinery plant. Electric power for the project will be provided by diesel powered generators with approximately 1,200 kilowatt capacity.

Drilling and blasting will occur in the pit, and the resulting ore and waste rock will be removed. Waste rock from the pit will be transported by haul trucks to two waste rock storage areas. Ore will be hauled to a stationary crushing facility, crushed to 80 percent minus 1½ inch size and mixed with lime. The crushed ore will be hauled to a conventional leach pad where a dilute sodium cyanide solution will be percolated through the ore for leaching. Gold will be recovered by carbon adsorption and stripping and refined by electrowinning and a doré furnace. Molten bullion will be cast into doré bars. Mining, ore processing, waste rock storage, heap leaching and associated operations and support activities at the mining site will be sources of air pollutants. The principal pollutants will be particulate matter less than 10 micrometers in diameter (PM_{10}), oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2) and volatile organic compounds (VOCs). The mine also has the potential to emit small quantities of hydrogen cyanide (HCN) and mercury (Hg).

Table 1 - Estimated Emissions

Summary of Controlled Emissions							
Pollutants	PM_{10}	NO_x	CO	SO_2	VOCs	HCN	Hg
Emissions, pounds/day							
Process	249	609	202	13.9	28.0	0.0	0.088
Non-Process	927	320	1,260	37.6	2.7	26.7	0.000
Total	1,176	929	1,462	51.5	30.7	26.7	0.088
Annual Emissions, tons/year							
Process	11.5	111.0	36.9	2.5	5.1	0.0	0.0083
Non-Process	71.5	16.6	65.2	1.9	0.5	4.86	0.0000
Total	83.0	127.6	102.1	4.4	5.6	4.86	0.0083

Table 2 - Summary of Permit Requirements

Emission Unit	Specie Emitted	Control Measure/ PM_{10} Control Efficiency	Emission Limit Opacity Standard (1)	Recordkeeping	Reporting
Drilling	PM_{10}	water injection, pneumatic flushing and/or dust shroud/85%	opacity ≤ 40%	compliance with Operation and Maintenance (O and M) Plan	semi-annual, summary report of recordkeeping requirements except for performance test results
Haul Roads	PM_{10}	water/chemical application/90%	opacity ≤ 40%	record date, time, intensity and roadway designation for both suppressant and water applications	
Off-road Machinery	SO_2, PM	0.05 percent or less sulfur content in diesel No. 2 fuel	opacity ≤ 40%	record the sulfur content of fuel burned per vendor specification	
Generators	SO_2, PM	0.05 percent or less sulfur content in diesel No. 2 fuel	opacity ≤ 40%; $E = 1.02\ Q^{0.769}$ (2); $SO_2 \leq 1$ lb/MMBtu	record the sulfur content of fuel burned per vendor specification	
Carbon Kiln	Hg, PM_{10}	baghouse/98% for PM_{10}; 90% for Hg	opacity ≤ 40%; $E = 4.10\ Q^{0.67}$ (2); $SO_2 \leq 600$ ppmv; $NO_x \leq 500$ ppmv	results of performance test for PM_{10}	results of performance test for PM_{10} within 30 days after testing is performed
Doré Furnace	Hg, PM_{10}				
Primary Crusher Secondary Crusher	PM_{10}	high pressure water sprays or equivalent/90%	opacity ≤ 10%;	secondary crusher performance test results	
				record ore processed and hours of operation, daily/monthly	semi-annual, summary report of recordkeeping requirements except for performance test results
				compliance with O and M Plan	
Ore Conveyor	PM_{10}	water sprays/83%	opacity ≤ 10%	compliance with O and M Plan	
Lime Silo	PM_{10}	fabric filter/99%	opacity ≤ 40%	compliance with O and M Plan	
Waste Dump Erosion	PM_{10}	water or chemical suppressant application/90%	opacity ≤ 40%	for water, record of date, time, intensity and pile designation	
Ore Storage Erosion	PM_{10}	water or chemical suppressant application/90%	opacity ≤ 40%	for water, record of date, time, intensity and pile designation	
Leach Pad	HCN	drip emitters; spray bars; pH control	HCN ≤ 0.3 ppmv, 8-hour avg.	measure and record pH value daily	
	NaCN	proper storage	NaCN ≤ 140 µg/m^3, 8-hour avg.	record of date of deliveries and the method of containment as delivered and stored	

Notes: (1) Measurement methods are: EPA Reference Method 5 for PM/PM_{10} mass emission rate; Method 9 for opacity; Method 6 for SO_2: and Method 7 for NO_x.
(2) E = pounds per hour; Q = heat input in MMBtu per hour.

All of these pollutants are regulated under Arizona and federal law with standards and guidelines that specify emission controls, emission limits and/or allowable ambient, off-site impacts of the pollutants. The estimated, maximum, total emissions from this project were determined as shown in Table 1. These estimates are based on the installation, operation and maintenance of the required controls and other permit requirements summarized in Table 2.

In the Arizona Administrative Code (A.A.C.), RI8-2-305 requires that Arizona Department of Environmental Quality (ADEQ) make all permits, including all required permit contents (subject to the confidentiality provisions of this rule), available to the public. A.A.C. RI8-2-330 specifically identifies how public participation is included in the air permitting process. A public comment period and hearing is required before the ADEQ can take any of the following actions:

1. A permit issuance or renewal of a permit,
2. A significant permit revision,
3. Revocation and reissuance or reopening of a permit,
4. Any conditional orders pursuant to RI8-2-328.F,
5. Granting a variance from a general permit pursuant to the Arizona Revised Statutes (A.R.S.) Section 49-.426.06(E) and A.A.C. RI8-2-507.

Any questions pertaining to these requirements should be directed to the Director of the ADEQ Air Quality Division (AQD).

ADEQ advertized, as required by law, this draft permit for public review. The advertisements appeared in the Wickenburg Sun and the Prescott Daily Courier on January 28, and February 4, 1998. A Public Meeting and Public Hearing were held on March 2, 1998 in the Wickenburg Community Center in Wickenburg, Arizona.

During the public review period, which closed March 16, 1998, written comments, questions, and objections were received by ADEQ. This **SUMMARY** presents the Department's responses to the issues raised by the public. The public's comments, questions or objections are summarized first **(C)**, and then each issue is responded to appropriately **(R)**. The issues that have resulted in revision to the Draft Operating Permit are so indicated. The result of this process is the ADEQ decision on this matter and the issuance or denial of the Class I, Air Quality Control Permit No. 1000383 to the YMC. The Department has determined that a permit should be issued. The file and draft permit will be sent to Region IX, Environmental Protection Agency (EPA) for review.

To avoid confusion by using abbreviations and acronyms, a list of such is provided on the final page of this Summary.

1. **(C)** The YMC proposes to use diesel driven generators, which emit pollutants (CO was mentioned) into the atmosphere, for electricity. Commercial line power is available. Why don't they use this clean source of electricity.

   (R) The federal and State rules and regulations establish the conditions with which YMC must comply. ADEQ analyzed the generator emissions and, through computer modeling, determined that there would not be an exceedance of a National Ambient Air Standard (NAAQS) caused by the generator emissions. A.A.C. R18-

2-719, Standards of Performance for Existing Stationary Rotating Machinery, provides the State rules and regulations under which YMC shall operate the generators. ADEQ determined that the operation of the generator will be in compliance with this applicable rule. Therefore, YMC has the power to decide whether to generate power, or use commercial line power.

2. **(C)** The Yarnell and surrounding communities cannot be characterized as the "general public". Many are there for medical reasons and the slightest change in air quality can be extremely detrimental to their health. The allowable ambient off-site impacts cannot be determined without a comprehensive study of the existing condition of our senior citizens.

   Opacity is being utilized as the primary means of measuring the most significant emissions - dust from roads, processes, and other disturbances, and exhaust from diesel engines. Health effects from particulate matter individually specific to both these sources are generally more pronounced in older persons. How has the potential impact on retired persons residing in the nearby communities been addressed?

   (R) Air quality impacts are assessed by comparing predicted impacts due to emission sources at the Yarnell Mine to State and federal ambient air quality standards. The federal ambient air quality standards have been established to reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare which may be expected from the presence of such pollutant in the ambient air in varying quantities. Under the federal Clean Air Act these standards must be set at levels which protect sensitive populations with a margin of safety. State ambient air quality standards must be at least as stringent as the federal standards. The latest scientific knowledge that is used by the EPA in establishing appropriate air quality standards includes health studies that consider people who are more sensitive to changing air quality conditions (e.g., the elderly, children, asthmatics, etc.).

3. **(C)** No study has been done in this area for the Hantavirus Syndrome. The Center for Disease Control, University of New Mexico, and various others in the scientific community have concluded that this virus is airborne and is transmitted from the excreted urine and feces of rodents, particularly deer mice. The historic old mine shafts on Yarnell Hill cannot be excluded as habitat for carriers of Hantavirus. The mortality rate for seemingly healthy individuals is 44%. The blasting and other disturbances of the area is a real threat to the community.

   (R) The Hantavirus was discovered in the early 1990s, and cases of infection have been identified in eastern Arizona. The disease begins with flu-like symptoms such as fever, cough, and severe muscle aches. It can progress rapidly to respiratory failure when the lungs fill with fluid. According to the Center for Disease Control and Prevention (CDC), infection may result from breathing aerosols of saliva, urine or fecal matter produced by rodents. The virus can also be contracted from rodent bites or the introduction of rodent excreta into the eyes or broken skin. According to the Arizona Department of Heath Services, the virus is rapidly inactivated when exposed to ultraviolet rays present in sunlight, reducing or eliminating the potential for infection.

   Mining activities could disturb areas that may be inhabited by infected rodents. The primary exposure threat would result from direct contact with rodents or rodent nests. The restriction of public access would limit the possibility of direct contact. As previously noted, the potential for transmission of the Hantavirus through dust

(fugitive particulate emissions) is limited due to its destruction when exposed to ultraviolet radiation. In addition, background PM_{10} concentrations in the area are measured to be 10.2 $\mu g/m^3$. Dispersion modeling predicts an increase of only three to four $\mu g/m^3$ for the annual average PM_{10} concentrations due to emissions from the Yarnell Project in the towns of Glen Ilah and Yarnell; thus the project-related PM_{10} impacts are low compared to background PM_{10} levels. The potential for exposure already exists due to windblown dust emissions from potentially contaminated areas proximate to Yarnell. Although it is difficult to quantify precisely the risk of exposure, it is unlikely that the mine would appreciably increase risks of Hantavirus exposure to nearby residents. In the unlikely event that a case should result, the Arizona Department of Health Services will respond.

4. **(C)** Air quality monitoring is not indicated as a requirement. Given the close location of nearby residential areas to the proposed mining operations, air monitoring stations in residential areas would assure that health concerns are being monitored and evaluated. Monitoring provides a means of assuring the public that their concerns are being addressed.

   (R) ADEQ considered the necessity of requiring ambient air quality monitoring of PM_{10}. ADEQ's assessment of the expected off-site, particulate impacts caused by emission sources at the proposed Yarnell Project using the maximum emission rates (potential to emit) included the assumption that the maximum modeled PM_{10} impact added to the maximum monitored background PM_{10} concentration would represent the most conservative estimate of maximum off-site ambient PM_{10} concentrations. ADEQ concurs with the language presented in the permit application report that describes the meteorological conditions that result in the maximum modeled impact in relation to the meteorological conditions that were monitored when the maximum background PM_{10} concentration was monitored. The meteorological conditions that create these two maximum events are significantly different. It is unlikely that the conditions that promote maximum off-site impacts and the conditions that create maximum off-site background concentrations will coincide. Maximum off-site ambient PM_{10} concentrations are likely to be lower than the maximum levels reported in the modeling analysis (see the more detailed discussion of this issue provided below at the end of this response). Nevertheless, ADEQ included this conservative assumption in its assessment of the Yarnell Project modeling analysis and, even given this conservative assumption, the modeling analysis demonstrated no expected exceedances of the health based National Ambient Air Quality Standards (NAAQS).

   It is noteworthy that, in addition to the conservative assumption described above, ADEQ recognizes (and it is confirmed in Section 234 of the 1990 Clean Air Act Amendments) that the emission factors and dispersion modeling tools typically result in conservative estimates of off-site impacts for surface mining operations. In addition, the maximum modeled PM impact occurred on the Yarnell Project boundary. Modeling analyses for surface mining projects typically reveal that modeled impacts decrease rapidly with distance from the project site. This is true for the Yarnell Project modeling analysis. For example, modeling showed that on the day during which the maximum PM_{10} ambient, 24-hour average concentration occurred, the concentration 100 meters (328 feet) to the east was 112.2 mg/m^3 (25 percent lower than the maximum concentration) and 100 meters (328 feet) to the north was 88.3 mg/m^3 (41 percent lower than the maximum concentration).

5. **(C)** Attachment "B"; Specific Conditions, III. Emission Limitations rely on opacity as the primary measurement of off-road machinery emissions, and maximum allowable particulate emissions rate for the generator emissions.

Although these are both diesel engine generated emissions, why aren't they measured in a consistent manner? What is the likelihood of combined emissions creating poor air quality in the surrounding area during periods of cold weather inversion or hot air stagnation?

(R) This anomaly results from the fact that the off-road machinery and the generator emissions are regulated by different State rules. Off-road machinery is regulated through A.A.C. R18-2-802, which contains the opacity limit but no maximum allowable emission rate. The diesel generators are regulated through A.A.C. R18-2-719, which contains both an opacity limit and a maximum allowable emission rate. Although the regulations are different, the ambient air quality analysis (modeling) is based on predicted mass emissions, including both the stationary diesel engines and the moving truck diesels. This analysis was performed for the worst meteorological conditions and, therefore, would include consideration of the combined emissions under the adverse conditions noted.

6. **(C)** Attachment "B": Specific Conditions, IV. Operational Requirements, C. Air Pollution Control, 2. Unpaved Roads, indicates differing water application intensities (gallons/square yard) for various areas. Why are the rates inconsistent, and how do they relate to reduction of fugitive dust by 90 percent.

   (R) Primarily, higher traveled roads require more suppressant than less traveled roads. The Midwest Research Institute conducted a study in 1988 for the EPA of the effectiveness of various dust suppressants. As a result of that study, an empirical equation was developed to estimate the efficiency with various parameters. The equation is:

   $$C = 100 - (0.8\ p\ d\ t/L)$$

   Where: C = average control efficiency (%),
   p = potential average hourly daytime evaporation rate (mm/h),
   d = average hourly daytime traffic (h^{-1}),
   t = time between applications (h),
   L = application intensity (L/m^2) or

   $$L = (0.8\ p\ d\ t) / (100-C).$$

   Assuming p, t, and C are constant, the required application intensity varies directly with the average hourly daytime traffic.

7. **(C)** Cumulative impacts of the project and other area contributors to air contamination must be incorporated in a substantive manner to fully understand and minimize the negative impacts of the proposed mine.

   (R) Those cumulative sources that are currently in place are included by the use of the measured background pollutant levels, which are added to the predicted impact of the mine to determine the total impact.

8. **(C)** Emissions from several sources are allowed to create a cloud with 40% opacity. This includes emissions from drilling, haul roads, off-road machinery, generators, carbon kiln and dorè furnace, lime silo, waste dump erosion and ore storage erosion. This number is too high and allows too thick and dark a cloud of contaminants to impair air quality in Yarnell and visual aesthetics along a scenic highway.

(R) Considering the level of control required, it is not anticipated that the maximum allowable opacity of 40 percent will be realized. The various emission units (facilities) are regulated under several different federal and State rules and regulations, each of which specifies the opacity limit for the covered emission unit. A.A.C. R18-2-901.1 and 901.2 incorporate, by reference, the New Source Performance Standards, 40 CFR 60, Subparts A and LL; the primary crusher, secondary crusher and the ore conveyor are "affected facilities" under this rule which limits such to 10 percent opacity. The remaining emission units, including the roadways, are covered by other rules as noted in Attachment "B". In all cases the opacity limit is 40 percent.

The method used to measure the opacity is EPA Reference Method 9, 40 CFR 60, Appendix A. For this method a trained, certified observer estimates the opacity every 15 seconds over a six minute period. The average of these readings is the opacity. Therefore, visible emissions can occur for short periods, but the 40 percent opacity limit will still be met.

9. **(C)** A speed limit should be imposed on all haul roads and processing roads in order to minimize release of particulate matter.

(R) Although a speed limit is not explicitly stated in the permit, the mining operations inherently limit the speed that can be realized. In order to determine an emission factor for the haul truck/roadway activity, a mean speed is required (see Response 11). From an emissions standpoint, the mean speed, not the maximum speed, is, therefore, the important variable. The mean speed used to estimate emissions from roadways is 15 miles per hour. For 60 ton capacity haul trucks this mean speed is dependent on the terrain (grades), road lengths (short in this case), the haul trucks capabilities, the operations cycle time and safety considerations. It is doubtful that a higher mean speed could be maintained.

PM_{10} emissions caused by haul truck travel over unpaved roads at the Yarnell Project are calculated using the AP-42 emission factor equation for unpaved haul roads (page 13.2.2-1). An analysis of the expected cycle times (the duration of time expected for haul truck round trips, as presented in the Yarnell Mining Plan of Operations, Refined Version No. 1, March 1996, page 7-15) and distances of trips indicates that the mean vehicle speed for haul trucks is expected to be approximately 6.0 miles per hour (40 percent of the assumed mean vehicle speed). Because the speed factor in the emission factor equation is a straight scalar, use of 6 mph as the mean vehicle speed would reduce haul road emissions at the project by a factor of 0.4 (from approximately 590 lbs PM_{10} per day to approximately 235 lbs PM_{10} per day). The table below shows the mean vehicle speeds for each of the three haul trip categories.

Haul Truck Trip	Cycle Time (round-trip) (hours)	Distance (round-trip) (miles)	Average Speed (miles per hour)
Pit to Crusher (ore)	0.18	0.6	3.3
Pit to Dumps (waste)	0.2	1.6	8.0
Crusher to Heap (ore)	0.1	0.4	4.0

	Weighted Avg Speed	6.05

10. (C) The air permit states that water will be used for dust suppression and additional additives may be used to aid in this purpose. It should be stated how much water will be needed for this purpose, where this water will come from and what the environmental impacts are of the suppressant additives.

(R) ADEQ has set the watering application rates and frequency (Attachment "B", Section IV.C.2). Based on this requirement Yarnell has performed a water balance and determined that they have an adequate supply from ground water wells, which are either on the mine site or are nearby and under lease, to meet the requirements of approximately 84,000 gallons per day.

The required chemical suppressant is "magnesium chloride ($MgCl_2$) or equivalent". $MgCl_2$ and similar suppressants are nontoxic and environmentally-safe products involving no hazardous ingredients. $MgCl_2$ and similar chemicals have been used in the mining industry and other industries for several years without any adverse effects reported.

11. **(C)** At the back of the permit, the proposed mine equipment which may contribute to air pollution is listed. However, in all cases, the specifics on the manufacturer, the model and the date of manufacture is "To be Determined". This lack of information is not acceptable. Different models and older vs. newer equipment will release different quantities of air contaminants. ADEQ must require that this information is provided, the agency should review whether or not the specific equipment proposed is acceptable, and the approved equipment should be stipulated in the permit.

(R) The make, model or year for the haul truck is not involved in the method used to estimate haul road and crusher emissions. For the tailpipe emissions, these factors are important; however, ADEQ does not have jurisdiction in the control of these emissions. The primary source of emissions at the mine are PM_{10} fugitives from haul road and drilling/blasting and process sources such as the crushers and material handling. EPA considers the best source of emission factors to be actual measurements on the specific unit or a similar unit. Even if the actual unit were known, the data required is not available. The second source of emission factors is EPA AP-42, Compilation of Air Pollutant Emission Factors. This data has been compiled by EPA and presented for various emission sources and operations. Since this is an aggregate of data, the information required is generic. For example, the haul truck roadway emission factors are determined as follows:

$$E.F. = k(5.9)\left[\frac{s}{12}\right]\left[\frac{S}{30}\right]\left[\frac{W}{3}\right]^{0.7}\left[\frac{w}{4}\right]^{0.5}\left[\frac{365-p}{365}\right]$$

Where:
E.F. = Emission Factor, pounds per vehicle mile traveled;
k = Particle size multiplier, 0.36 for PM_{10};
s = silt content of road surface material, percent;

S = Mean vehicle speed, miles per hour;
W = mean vehicle weight, tons;
w = mean number of wheels;
p = number of days with at least 0.01 inches of precipitation per year.

The crusher emission factors are given as pounds PM_{10} emitted per ton crushed for primary, secondary or tertiary crushers.

12. **(C)** Particulate matter, which is likely to be significant from this project and which will impact area residents, absolutely must have performance tests more frequently than biennially (page 17).

(R) Virtually all of the emissions are fugitives that do not lend themselves to performance testing; rather, one must rely on opacity observations. The two sources that are true point sources, the baghouse servicing the lime silo and the baghouse servicing the carbon kiln and the dorè furnace, are relatively small emission points. ADEQ has determined that a biennial test is sufficient, based on the historic reliability of baghouses.

13. **(C)** Who will be testing hydrogen cyanide emissions, and how frequently? Page 12 states that the permittee shall not cause or allow hydrogen cyanide to be emitted to exceed 0.3 parts per million in any occupied place beyond the premises. Who will do this testing? How frequently will it be done? How are nearby residents to know if the 0.3 ppmv has been exceeded in or near their homes? How about impacts to "unoccupied" places - such as the public land open to public use immediately adjacent to the proposed project area?

(R) ADEQ has not been able to identify a reliable in situ, continuous HCN ambient air monitor. Therefore, the only method available would be to capture a sample over time and then send the sample to a laboratory for gas chromatographic analysis. Obviously, this procedure has a protracted response time, and therefore, would not serve the purpose of giving warning of a problem. In this case, compliance is determined by measuring the pH of the heap leach solution. ADEQ has determined that, if the pH is 10.5 or greater, the ambient HCN concentration will be less than the ambient air quality standard of 0.3 parts per million.

ADEQ interprets "occupied" places to be any area that the public has access to.

14. **(C)** The material under the leach pad is identified as ≤¾" dia. (APP permit) and the air quality permit describes ≤1.5" on top of the liner.

(R) In order to protect the liner an 18 inch layer of minus ¾" diameter ore is laid down first. Additional ore material that is added is minus 1.5" diameter.

15. **(C)** The assumptions used in the PM_{10} modeling likely underestimate the ability of YMC to achieve the required 90% particulate reduction efficiencies. For example, road watering will require approximately 84,000 gallons per day, while the site will only have a single 5,000 gallon truck. Besides the fact that such limited equipment may not have the capacity to do the job under normal conditions, the likelihood that such a truck would periodically break down - with no backup on site - renders "mitigation" untenable.

(R) The total water application rate based on the permit application intensities and frequency, as tabulated in the permit, Attachment "B", Section IV.C.2, is 84,000 gallons per day. This rate is a conservative estimate based on the maximum daily mining activity. This additional water was determine to be necessary to provide 90 percent roadway control. By that permit condition YMC has three options to maintain 90 percent control. The primary and preferred method of control is to apply water at intensities and frequency listed in the table included therein. There are also the options to reduce the water requirements by using a chemical dust suppressant or directly reduced water application with ADEQ approval.

YMC has determined that four to ten gallons per minute will be required to maintain a moisture content in the ore that will result in meeting the opacity and emission limit requirements. The crusher spraying circuit has the capacity of 20 gallons per minute, which should accomplish this objective. The YMC water balance demonstrates that these requirements can be met.

16. **(C)** The modeling used to calculate the projected maximum 24-hour emission was based on erroneous assumptions. For example, documents in the record indicate that the modeling for maximum emissions was not based upon the maximum emission condition:

- **!** Particulate emissions due to erosion at the waste storage areas have been calculated assuming that one-third of the total disturbed area will be active at any given time.
- **!** Particulate emission due to erosion at the leach pad have been calculated assuming that one-sixth of the total disturbed area will be active at any given time.

(Application submittal document revised February 6, 1997, at page 22). Clearly it is possible, indeed likely, that more than 1/3 or 1/6 of these particulate emission sources will be "active" at a given time. As such, the maximum emission would rise - likely above the 150 $\mu g/m^3$ standard. Based on standard mining practices, and YMC's Plan of Operations, the waste rock and heap leach facilities will not be so "inactive" as YMC's air modeling assumes. Until reclamation is completed for these and other areas, the facilities are active, not inactive. At a minimum, the ADEQ should have investigated and verified that these and other assumptions represent actual conditions at the site.

(R) It is imperative, as you infer, that ADEQ assure that these limits are met. The assumptions that one-third and one-sixth of the total area for waste storage and leach pad, respectively, will be disturbed at one time are stated in both the permit application and the Mining Plan of Operations, are the bases for the analyses performed. As such, the mine is required to observe these limits. If YMC operations exceed these limits, the mine would be in violation. Also see Response to Comment #4.

YMC has projected the amount of waste storage that will exist at full build-out. As they build the piles they will be adding new material to only one-third of the area (active area) that will be used at full build-out. Although the waste rock is mostly too large to blow, there are some fines that will be blown off the surface of the piles. When the pile is complete (inactive), the surface fines are gone and the emissions are negligible.

The heap leach pad is comprised of 80 percent minus 1.5 inch material, which is larger than most decorative rock used as garden cover. Also, the surface will be wetted by the leach solution. As a result of these two factors, there is virtually no PM_{10} emissions from the heap leach pad.

The primary concern with regard to the heap leach pad are the HCN emissions. The fraction of the total heap leach pad that is active is actually inconsequential as the active area used in the emission estimate is 261,360 ft^2. The heap leach pad is formed by building up cells which are treated with the dilute NaCN solution from a drip distribution system. The distribution system is designed to deliver 1200 gal/min of solution. The required application is 0.005 gal/min/ft^2. Therefore, the active area is approximately 240,000 ft^2. In reality the active area is estimated to be 261,360 ft^2. A cell is active for about 100 days during which time HCN emissions occur. During that time a second cell is prepared. When the previous cell is complete, the drip system is moved down to service the new cell. The HCN emissions occur when the surface solution reacts to form HCN. When the supply of NaCN is stopped, the emissions almost immediately drop to zero.

17. **(C)** Also, the sampling to estimate background concentrations was only done every third day during the limited one year sampling. What if a high particulate event occurred on one of the majority "off" days? Due to the almost identical emission projection/standard, the ADEQ should have investigated these sampling methods more carefully. There is nothing in the record to indicate that sampling that missed two-thirds of the data are reliable. ADEQ officials recognized the problems inherent in this approach:

With only 1 year of on-site data collected, it is unknown as to whether or not this data represents typical or atypical conditions. In addition, PM_{10} monitoring on an every third day basis leaves the possibility that the maximum background concentration was missed. Therefore, although the Yarnell Mining Company demonstrated with on-site monitored data that the 24-hour PM_{10} NAAQS was met, the potential for a 24-hour PM_{10} exceedance still exists.

ADEQ Inter-Office Memorandum from Donna Lucchese to Arthur Hofmeister dated October 21, 1996, at page 6. In a further letter to YMC, the ADEQ highlighted the lack of confidence in the sampling approach used: "Unless ambient monitoring has been performed on a daily basis for a number of years, sampling other than on a daily basis (...in the Yarnell case, every 3rd day) **underestimates the maximum by missing the maximum**." September 5, 1996, letter from Donna Lucchese to Mark Montoya, YMC, at page 1 (emphasis added).

(R) The statement should have read, "... could *underestimate the maximum by missing the maximum."*

It is technically appropriate to use on-site baseline data to estimate representative background PM_{10} levels and to add these representative PM_{10} levels to the modeled PM_{10} impacts for purposes of comparing expected ambient PM_{10} levels to the NAAQS for PM_{10}. Baseline PM_{10} monitoring was conducted voluntarily by Yarnell (i.e., there is no regulatory requirement for YMC to conduct this monitoring). YMC elected to collect baseline PM_{10} data to improve the quality of baseline air quality data specific to the project area. YMC collected the baseline PM_{10} data for a one-year period using required regulatory methods and on a 1-in-3 day sampling schedule. This sampling schedule is twice as frequent as the nationally prescribed 1-in-6 day sampling schedule of PM_{10} monitoring programs in attainment areas (which is the appropriate designation for the Yarnell Project area). YMC's sampling program met or exceeded required data capture rates. ADEQ has reviewed the baseline PM_{10} data collected by YMC and has determined that the data are representative of background PM_{10} conditions at the project site.

With regard to the appropriateness of adding modeled maximum PM_{10} impacts to the estimated background PM_{10} concentrations (based on YMC's baseline data), ADEQ has used the worst-case assumption that maximum off-site impacts will coincide with maximum background PM_{10} concentrations and has used the sum of these values to compare to the NAAQS for PM_{10}. The sum of maximum impact and the maximum background level is less than the NAAQS. ADEQ maintains that this approach is conservative and has made its determination to issue a permit to YMC based on the assumption that the maximum ambient concentration case has been presented in the modeling analysis. Please also see the response to comment number 4.

18. **(C)** More significant is the fact that the maximum emissions projection was not based on maximum emission conditions. For example, the application documents admitted that **"This predicted 24-hour maximum concentration occurred on a day when the winds were light (average winds speed = 2.8 m/s)."** (Application submittal document revised February 6, 1997, at page 33, emphasis added). However, this data result directly conflicts with ADEQ policy. In a July 30, 1996, letter from Donna Lucchese to David Randall at Air Sciences, Inc. (YMC's contractor), the ADEQ stated that:

For the past two years, ADEQ has required sources with pit mines to demonstrate that under a synoptic event (wind speeds greater than or equal to 15 miles per hour), emissions from the pit would not exceed the NAAQS for PM_{10}. We request that you access your meteorological data file (used in your refined analysis and select days which meet wind speeds greater than or equal to 15 mph. In term of a realistic analysis, we suggest that you examine days in which the consecutive wind speeds for a 5-hour period exceed the 15 mph threshold. A 24-hour refined modeling analysis should be performed for each of the days which meet the criteria.

There is no adequate evidence that this significant problem was satisfactorily addressed. It should be stressed that the 149.8 $\mu g/m^3$ projection was **never** changed as a result of these requested revisions. It has remained at that level since at least March of 1996 when YMC submitted its revised Plan of Operations. The ADEQ cannot issue the permit until such contradictions and errors are rectified.

(R) Wind speeds as they relate to modeling results are not simply a black or white issue. Winds are one of the many variables that affect the end modeling result. In the first case regarding light winds, they can affect modeling in many ways. In this case light winds did not result in much dispersion, which resulted in the maximum concentration. They could have also played the other end of the scale, by not "kicking up" particulate matter, resulting in low emissions and, therefore, a lower concentration.

Regarding the synoptic event, this is ADEQ's way of evaluating a scenario such as a monsoonal event. Monsoonal events often result in dust storms; therefore, this is ADEQ's way of evaluating the "kicking up" of particulate matter under high winds. In this case, the light winds event resulted in higher emissions than the high wind event. Like all modeling cases, each is individual and each need to be evaluated on a case-by-case basis. We have had opposite results with winds in different modeling cases. Therefore, ADEQ cannot evaluate the situation and presume the results based upon one variable. This is why we had the January 20, 1993 modeling run; to cover both ends of the spectrum and everything in between. As concluded, the revised modeling analysis did not change the 24-hour impact; however, the annual impact increased by 0.2 $\mu g/m^3$, as stated in the final modeling memo: October 21, 1996, Memo to Arthur

Hofmeister from Donna Lucchese.

19. **(C)** As noted above, serious questions remain as to whether the readings, sampling, and modeling are accurate and appropriately conservative. For example, it appears that the PM_{10} modeling was run using data from January 20, 1993. See September 16, 1996, letter from Donna Lucchese to Trent Doyle of Air Sciences. Does this data represent maximum emission conditions? Based on site-specific conditions, as well as on YMC's own submittals, this cannot be the case. For example, December and January are the "wettest" months of the year when calculated based on evaporation rates (and one of the wettest based on precipitation). See YMC's March 1996 Mining Plan of Operations, at page 3-2.

(R) The PM_{10} modeling, which was performed using data from January 20, 1993 (see September 16, 1996, letter from Donna Lucchese to Trent Doyle of Air Sciences), was based upon one day of meteorological data that was excluded from the previous modeling run because of the number of "calm hours". This issue was addressed in the September 30, 1996, letter from David Randall to Donna Lucchese. This modeling request was not meant to represent maximum emission conditions, rather it was to make sure that all of the monitored meteorological conditions were represented and addressed in the modeling analysis. Therefore, this additional modeling was performed to complete the modeling analysis.

As far as the time of year and representative precipitation, generally modeling does not take into account precipitation or humidity. For the most part, modeling is performed based upon temperature, wind speed, wind direction, topography, operating hours, stack parameters, emission rates, and location of sources and receptors.

20. **(C)** The "closeness" of the projected emissions and the standard is further called into question due to the lack of any mention in the Aquifer Protection Permit (APP) that a scientifically-acceptable margin of error was factored into the final number. Under any conservative, let alone realistic, approach, a margin of error factored into the projection will yield a projected emission that will violate state and federal air quality standards. Since it is admitted that the modeling only "estimates" projected emission levels, a margin of error must, by definition, be included. Without this, the final number is unreliable. In addition, the use of a general 28 $\mu g/m^3$ number, with no decimal point given, violates acceptable scientific and engineering practice to use significant figures in all calculations. The fact that any upward deviation would violate the standard further calls into question the scientific accuracy of the projections.

(R) The margin of error is discussed in the Response to Comment #4.

The NAAQS established by the EPA must not be exceeded. Therefore, the modeled impacts when combined with background must be at, or below, the NAAQS. In this case, the standard is 150 $\mu g/m^3$, so even if the number 149.8 $\mu g/m^3$ is rounded up to 150 $\mu g/m^3$, the maximum modeled impact is still at or below the standard. The maximum 24-hour background value of 28 $\mu g/m^3$, was in fact 28.0 $\mu g/m^3$, and should have been properly indicated as such. The average annual monitored background was 10.2 $\mu g/m^3$.

21. **(Ca)** Another fundamental omission is the lack of cumulative air impacts analysis. In other words, what will be the projected emissions when added to the reasonably foreseeable and existing activities in the area?

Since the Bureau of Land Management (BLM) must review and consider these impacts when reviewing air quality issues in the National Environmental Act (NEPA) process (and supply the required "quantified or detailed information"), it is almost certain that the final projected emission will exceed the 150 $\mu g/m^3$ standard. Thus, in order to comply with federal and state law, the ADEQ should revise its projections based on a cumulative impacts analysis.

(Cb) It also appears that unlike other NAAQS parameters, PM_{10} was not calculated using projected emissions from other air emission sources. For example, Attachment 2 to Air Sciences' June 9, 1995, submittal to ADEQ (Bill Kuby)(emphasis added), admits that for all NAAQS except PM_{10}: "the estimated impact from the proposed sources' emissions is added to the measured background concentration **and modeled impacts from major stationary sources within a 50 kilometers radius to demonstrate whether total impacts will exceed NAAQS levels."** The document goes on to acknowledge that, unlike the other NAAQS parameters, PM_{10} modeling did **not** factor in other nearby sources - relying instead on the flawed and very limited "ambient" data set.

(R) The type of modeling analysis required for a Class I source that is not subject to Prevention of Significant Deterioration (PSD) analysis does not require that the applicant, in addition to monitoring background ambient concentrations, analyze the projected impacts of industrial, commercial, residential and general (temporary and mobile sources) within the facility impact area. In this case the cumulative emissions are accounted for by adding the maximum modeled concentration due to the mine to the monitored baseline, background, ambient concentration for the same averaging period. This is used to determine whether or not the ambient air impacts exceed the NAAQS.
In order to establish the baseline, background, ambient concentrations, YMC voluntarily gathered local ambient PM_{10} and meteorological data for one-year.

22. **(C)** Additional PM_{10} concerns involve the use of Phoenix and Winslow air conditions for modeling Yarnell emissions - clearly not realistic indicators of local conditions.

(R) The dispersion model requires the use of upper atmospheric conditions, which are more generalized than surface conditions as a result of less friction. Mixing height values are used to calculate stability. Since upper air soundings are collected at only two sites in Arizona (Tucson and Winslow), we generally use the closest site. ADEQ has on many occasions allowed the use of Desert Rock, Nevada's upper air station for many sites in northwestern Arizona. In this case ADEQ accepted the Winslow data as the most reasonable, available data.

23. **(C)** The permit lacks any discussion of data as to whether the 90% efficiency and efficiencies for other emission sources such as onsite power generation actually achieve these results at all times - especially under high wind conditions that would likely reduce the projected efficiencies and cause the PM_{10} standard to be violated. Furthermore, no evidence is given regarding whether the modeling or calculations were based on the full build-out year, with maximum operation, production, and disturbance, including fully-emitting on-site power generation. It must be remembered that **any** deviation from the projected conditions would likely violate the air quality standard.

(R) The information that you are inquiring about is not in the permit, but was relied upon to develop the permit conditions. The methodology used to determine the water application intensity and frequency has no correction for wind speed. If this becomes a problem, it will be manifested in increased opacity. If this persists the ADEQ will require the application of a dust suppressant, as provided for in the permit. The generators do not have emission controls, except that all diesel engines will utilize very low sulfur fuel (less than 0.05 percent sulfur). The emission calculations are for the maximum activity rates for emission sources to occur during the five-year term of the permit. Further, the configuration of the pit does not require long, winding access roads into the pit. The mining and process area is relatively compact; consequently the length of the roads traversed by the trucks that pick up the ore and transport it to the crusher are virtually unchanged during the duration of the mining.

24. **(C)** Regarding non-PM_{10} emissions, the ADEQ acknowledged that "[the air quality permit application (#1000383) submitted to the Department on April 19, 1996 contains air quality modeling results **which predict exceedances of the one hour AAAQG for NO and HCN**." June 4, 1996, letter from William Kuby to Mark Montoya (YMC). This letter goes on to allow that such exceedances are acceptable. However, this conflicts with ADEQ statements that the applicant "should demonstrate that the Arizona Ambient Air Quality Guidelines (AAAQG's) for Hydrogen Cyanide will be protected." June 28, 1995 letter from Steve Calderon (ADEQ) to David Randall (Air Sciences). Also, YMC itself admits that "ADEQ views the Arizona Ambient Air Quality Guidelines (AAAQG's) as state standards for hazardous air pollutants." May 24, 1995 letter from Mark Montoya to Bill Kuby.

The ADEQs position that the AAAQGs can be violated is incorrect. As such, the permit cannot be issued under such conditions.

(R) A federal ambient air quality standard for NO_2 and a State ambient air quality standard for HCN exist in code,
and, therefore, take precedence over the State guidelines. The AAAQGs, unlike the NAAQS, are not codified, but are guidelines which call for risk management decisions when modeling predicts that ambient air levels could exceed the AAAQG limits. In addition, there exists a 10-fold margin of safety built into the AAAQGs. This margin of safety often plays a key role in the risk management decisions that are made. In this case, a federal Standard for NO_2 exists (assuming NO_x is fully converted to NO_2), which is not as stringent as the AAAQG, but takes precedence over the State guideline. For HCN the State rule (A.A.C. R18-2-730.J) establishes an ambient standard which is less stringent than the AAAQG. The modeling studies verified compliance with these federal and State standards.

25. **(C)** The ADEQ should not issue the permits until the federal National Environmental Policy Act (NEPA) and approval process is completed. Currently, the Bureau of Land Management (BLM) along with other federal agencies, are preparing an Environmental Impact Statement (EIS) for the Yarnell Project. As required by NEPA and other federal laws, the BLM will use the NEPA process to review the Project as proposed by YMC, as well as alternatives to the design, construction, operation, reclamation and closure of the Project.

It is very possible, indeed highly likely, that the BLM and/or the other federal agencies will require

significant revisions to the mine plan, reclamation plan, etc. Thus, the Project description, operational characteristics, environmental impacts, etc., that form the basis of the ADEQ permits will change. As such, the ADEQ permits would have to be redone, with full public review, comment, and appeal rights. In essence, there really is no "project" at the present time since the discharge points and levels, environmental impacts, etc., are largely speculative. The ADEQ should not permit such a proposal.

ADEQ has affirmed this requirement that the APP be held until the NEPA process is completed. For example, an ADEQ Inter-Office Memorandum (May 10, 1995) from Bill Kuby (AQD/PSNSRU) to Prabhat Bhargava stated that "I told them [YMC] that I believed AQD would not issue the permit prior to completion of the federal process...." This statement was in response to Mr. Kuby's remark that: "They [YMC] would like to receive the State permit in six to eight months in the hope that such would put pressure on BLM to complete the EIS by the end of 1996."

ADEQ has also specifically noted the direct connection between the EIS and ADEQ processes. "It is anticipated that the air quality analysis for the Class II [now Class I] application will be identical to the air resources section(s) of the EIS." ADEQ Notes, Pre-Application Meeting, Yarnell Mining Company/ADEQ, May 9,1995. Since it is clear that ADEQ believes that the EIS and ADEQ processes are linked, and since such EIS analysis is not completed (let alone released in draft form), the ADEQ air analysis is by definition incomplete until the federal EIS and approval process is completed.

(R) ADEQ and YMC both realize that the final EIS may result in changes in the Mine Operating Plan that might require ADEQ to reevaluate the project and possibly reopen for cause (A.A.C. R18-2-321) and revise the permit. A reopening and revision may require new modeling and would be open to public comment as was this draft permit. ADEQ is required under rule to respond to each and every permit application in a reasonable time frame, which we are doing.

26. **(C)** Conditions stated in Attachment "A" allow too much flexibility such that the permittee would be able avoid meeting compliance issues in a timely manner, etc.

(R) The conditions in Attachment "A" are, in the most part directly from A.A.C. Article 3 as cited. Article 3 was adopted to meet the requirements of 40 CFR 70, State Operating Permits Programs. In accordance with the Clean Air Act Amendments (1990), the YMC mine is a Class I, Title V source, which requires implementation of 40 CFR 70 rules and regulations. ADEQ has received interim approval of its Title V program by the EPA, Region IX. Attachment "A" reflects the approved State rules under the federal program. Under these conditions the Department can not arbitrarily alter Attachment "A".

27. **(C)** Attachment "B", Section IV.C.l.c: Information I've received says baghouses are not state of the art for such filtering and don't meet current BADCT.

(R) It is presumed that the reference is to Best Available Control Technology (BACT). BACT is only required for sources subject to Prevention of Significant Deterioration (PSD) regulations. Since no regulated pollutant is emitted in excess of 250 tons per year (excluding fugitives), the YMC mine is not subject to PSD; however, fabric filters (baghouses) are the predominant BACT for PM_{10} emission control.

YMC will install two baghouses; one servicing the lime silo and the other servicing the carbon kiln and the dorè furnace.

28. **(C)** Attachment "B", Section VI: Equipment utilized on the mine property(excluding paved public parking area) should not be allowed on public off-site areas. Trucks/containers receiving or shipping should be water flushed (drainage collected) before going off-site.

(R) ADEQ has no jurisdiction once the vehicle is beyond the property boundary.

29. **(C)** Attachment "B", Section VII: All testing should be observed by ADEQ personnel.

(R) All testing is observed by a Compliance inspector.

30. **(C)** Attachment "B", Section VII.G: At no time should runs over the applicable emissions standard be averaged with sub par runs.

(R) The procedures used to conduct a performance test for PM or PM_{10} are established by federal rule, 40 CFR 60, Appendix A, Reference Method 5. This test procedure requires that the arithmetic average of the results from three test be used to determine compliance.

31. **(C)** Attachment "B", Section VII.H.5: This is absurd. If you don't perform by the date, change the date.

(R) Should a significant deadline in a compliance schedule not be met, the permit condition, Attachment "B", Section VII.H.5, requires YMC to notify ADEQ and state the reason. ADEQ will then, based on an evaluation of the cause of the delay, either establish a new schedule or take other appropriate action.

32. **(C)** The Summary should specifically include the leach pad as a source of pollution.

(R) This has been done.

33. **(C)** Does the applicant intend to fill in the open pit and restore the land to some semblance of its former condition if the operation were to be allowed to proceed?

(R) The applicant has submitted a "Closure and Reclamation Plan" with the BLM, and forwarded a copy to the ADEQ Aquifer Protection Permit (APP). If interested, a copy may be obtained from one of those agencies.

34. **(C)** As I understand it, ADEQ is not mandated to take into consideration the costs which might be incurred by an applicant in minimizing pollution. Obviously, open pit mining is a very primitive and polluting form of gold mining, and cyanide heap leaching is a very primitive and polluting, potentially disastrous, form of gold recovery. Why doesn't the ADEQ require that the applicant use more sophisticated, advanced, and far less polluting methods of mining and recovery, such as underground mining and closed circuit cyanide recovery?

(R) The AQD does not have the authority to make business decisions for the applicant. Rather, it is our responsibility to evaluate whether a specific proposal can be constructed and operated in compliance with all appropriate rules. We are authorized to condition the permits to assure compliance, but cannot change a fundamental approach to a proposed project.

35. **(C)** The application states that the mine wishes to be allowed to emit 1176 pounds [per day] of PM_{10}, or 214.62 tons per year. The application misstates this amount; their stated total is only 83 tons per year. Is this an intentional understatement? Likewise, nitrogen oxides, carbon monoxide, and sulfur dioxide emissions are understated. The correct figures, using their 'pounds per day' amounts times 365 days in a year, are 169.54 tons of nitrogen oxides, not 127; 266.8 tons of carbon monoxide, not 102.1; and 9.4 tons of sulfur dioxide, not 4.4. A pollution source which would emit such quantities of dangerous gasses and dust particles within such close proximity to established homes and businesses is simply unacceptable.

(R) The daily and annual emission rates are correct as reported. The emission rates that the commentor reports were calculated by multiplying the daily rates by 365 day per year, e.g., the daily emissions of PM_{10} of 1176 pounds per day (0.588 tons per day) multiplied by 365 is 214.62 tons per year. This approach has imbedded in it the assumption that the activity rates for each source are the same every day of the year. This is not true. The actual activity rates must be utilized. Also the operational limits must be considered. The permit (Attachment "B", Section V.A) limits the ore processed to 15,600 tons per day and 1,200,000 tons per year. If YMC were to process 15,600 tons per day for 365 days per year they will have processed 4,060,000 tons per year, a violation of their permit.

36. **(C)** I want to know specifically what volatile organic compounds would be emitted by the proposed mining operation. Odors from VOCs can be very offensive as well as potentially causing cancer and other illnesses; coupled with the sulfur dioxide and HCN emissions, residents near to this operation might find their homes uninhabitable when the wind is in their direction. Specifically, I want to know what odors residents will be subjected to at specific distances from the proposed pollution source. This is a critical point. Noxious odors definitely effect the quality of air, and one's quality of life. I would like to see information from ADEQ projecting what potential levels of odor causing compounds could be expected at established residences in Yarnell and Glen Ilah, as well as scientifically documented data as to the sensitivity of the human olfactory system to said levels. Surely such data must become a part of the application. Data should also be included which sets forth the levels of PM_{10} which can be expected by the residents of Yarnell and Glen Ilah at their respective residences. This is not an outrageous request; this company wants to put an open pit cyanide heap leach mine in OUR BACKYARD, and we have a right to know what to expect if such an operation is permitted.

(R) The permit application for the project included an air quality analysis to assess ambient concentrations of pollutants, including VOCs, emitted as a result of the project.

The odor assessments for HCN and diesel emissions are quantitatively based on the results of the air quality analysis. The maximum ambient HCN impact predicted in the modeling analysis was 59.7 $\mu g/m^3$ (0.0597 mg/m^3). This one-hour impact was predicted to occur along the southern modeling boundary and is well below the range of odor thresholds (0.2 to 5.5 mg/m^3) for HCN as presented in *Hydrogen Cyanide*

Health Effects (EPA-460/3-81-026). The impact is less than 30 percent of the most restrictive odor threshold. Note that modeled impacts at sensitive receptors in the towns of Yarnell and Glen Ilah (where public sensitivity is greater) were much lower than this maximum impact.

The primary contributors to diesel exhaust odor intensity include about 2,000 distinct chemicals contributing to a smoky-burnt odor and about 200 chemicals contributing to an oily-kerosene odor. Hydrocarbons (HC) constitute the majority of these odorous compounds. Nitrogen dioxide (NO_2) also contributes to odors resulting from diesel exhaust.

The one-hour VOC impact was broken down into estimated impacts for thirteen compounds that account for the majority of hydrocarbons contained in diesel exhaust. All estimated one-hour impacts are below the respective odor thresholds for compounds with known odor thresholds. For the six constituents with no known odor threshold, the lowest odor threshold for the other major HC constituents was used to provide an assessment of odor-causing potential for these compounds. Impacts for these compounds were below the assumed odor threshold of 0.04 ppmv.

Because odors can be detected for exposure times on the order of several minutes (Feldstein et al., 1973), the one-hour averaging period may not be short enough to characterize an odor problem. Feldstein et al. (1973) indicates that a three-minute average concentration is not expected to exceed the odor threshold more than once per year if the annual arithmetic mean concentration is less than or equal to five one-thousandths of the odor threshold. The annual VOC impact was broken down into estimated impacts for the same thirteen HC compounds. The percentage of HC emissions, estimated annual impact, and 5/1,000 of the odor thresholds for the 13 compounds were examined. Annual ambient impacts exceed the 5/1,000 odor threshold for only one compound (propene), and this impact is only 5 percent higher than the 5/1,000 odor threshold. Due to the conservatism built into this analysis, the actual impact for this compound is unlikely to result in an exceedance of the odor threshold for more than one three-minute period during the year. Based on this assertion, no odor impacts are expected to result from hydrocarbon emissions for the project.

The maximum ambient NO_x impact predicted in the modeling analysis was 40.2 $\mu g/m^3$. Assuming total conversion of NO_x to NO_2, this annual impact is equivalent to 0.021 ppmv and was predicted to occur to the southeast of the facility. As previously stated, a three-minute average concentration is not expected to exceed the odor threshold more than once per year if the annual arithmetic mean concentration is less than or equal to five one-thousandths of the odor threshold. The odor threshold of NO_2 is 3.4 ppmv (geometric mean as per Linnell and Scott, 1962); five one-thousandths of this odor threshold is therefore 0.017 ppmv. The annual NO_x impact is thus approximately 24 percent greater than five one-thousandths of the odor threshold for NO_2. Based on this analysis, at least one exceedance of the odor threshold may occur in a given year; however, for this analysis, all NO_x was assumed to be emitted as NO_2. USEPA's G*uideline on Air Quality Models* allows for a nationwide default factor of 0.75 for the conversion of NO_x emissions to NO_2. Although the conservative technical approach adopted to assess odor impacts of NO_2 indicates the potential for the three-minute average concentration to exceed the odor threshold of NO_2, actual occurrences of exceedances of the odor threshold are expected to be infrequent if not unlikely.

37. **(C)** I notice that there is no estimate in the application as to just how much dust will be created by the proposed blasting. Even if a certain level of dust emission is permissible on an annual basis, it is simply not the same if the vast majority of same is all released in a blast that occurs in seconds, twice a week. There is also the question of what gasses may be emitted during blasting. The proposed mine will be exposing rock that has been buried for millions, if not billions, of years. What potentially dangerous air-borne compounds may be released as this rock is exposed to the force of blasting and then excavated.

(R) The estimates for emissions from blasting operations are in Appendix A, Emissions Inventory, Tables VII and VIII of the revised application, June 1996. The estimates are 44.2 pounds of PM_{10} for a single blast and 2.30 tons for 104 blasts in the maximum year. Also see Comments #3 and #41.

The blasting emission factor (85.3 lbs TSP/blast or 44.2 lbs PM_{10}/blast using a PM_{10}/TSP multiplier of 0.52) was referenced in an EPA Policy Paper (1979). The referenced document is an Interim Policy Paper that addresses EPA's air quality permitting responsibilities regarding surface mining operations. The Interim Policy Paper was distributed by EPA Region VIII in 1979. The Paper includes particulate emission factors in Appendix B. The emission factor used in the Yarnell Mine emissions inventory is the emission factor representing emissions from blasting overburden in Northeast Wyoming (85.3 lb/blast). This is the largest emission factor available for blasting in this document. The Interim Policy Paper references EPA Document EPA-908/1-78-003, "Survey of Fugitive Dust from Coal Mines," by PEDCO Environmental, Inc., February 1978.

By way of comparison, AP-42 contains a blasting emission equation in the Western Surface Coal Mines section (Table 11.9-2). This equation uses the horizontal area of the blast as a parameter. The equation is:

$$PM_{10} = (0.52)0.0005A^{1.5}$$

where A = Horizontal area (in square meters) with blasting depth $\leq$ 70 feet.

To estimate the horizontal blasting area expected for the Yarnell Project, two parameters are used. These parameters (included in Table VI of the Yarnell emissions inventory) include the average number of blast holes expected per blast (200 holes), and the surface area of blast pattern represented by each blast hole (10.7 square meters/blast hole). Thus, the total horizontal area expected for each blast at Yarnell is 2,138 square meters (200 holes x 10.7 m^2/hole). Plugging this value in the AP-42 emission equation presented above results in a PM_{10} emissions estimate of 25.7 lbs PM_{10} per blast. One must acknowledge the imprecision of the emission factors intended to estimate emissions from blasting at surface mining operations.

Both emissions factors (the 1979 EPA Interim Policy Paper emission factor and the AP-42 emission factor) should be viewed as estimates of blasting emissions. Recognizing this, the more conservative of the two factors was used to represent emissions at the Yarnell Mine.

The explosive will also contribute to the gaseous pollutants emitted. The estimates for gaseous emissions

from blasting operations are in Appendix A, Emissions Inventory, Table IX of the revised application, June 1996. The following emissions estimates, in pounds per blast are:

Pollutant	Emissions (lbs per blast)
NO_x	320
CO	1260
SO_2	37.6
VOC	2.7

Also see Comment/Response #3. These emissions were included in the modeling analysis for the maximum emission day.

38. **(C)** As to the proposed HCN emission levels: how can the ADEQ seriously consider giving the applicant the RIGHT to discharge 27.6 POUNDS of DEADLY hydrogen cyanide gas per day into the air within such close proximity to established residences and businesses?

(R) The emissions estimated for HCN were modeled to yield the predicted ambient concentrations. The resulting maximum ambient concentration are 0.05 ppmv (1-hour average) and 0.035 ppmv (8-hour average). The standard (A.A.C. R18-2-730.J) is 0.3 ppmv. The emissions of HCN were estimated using a mass transfer working equation reported in USEPA Document No. EPA/540/1-88/001, April 1988, "Superfund Exposure Assessment Manual". The ambient concentration of HCN at the surface of the heap was obtained from a previous study at the Mesquite Gold Mine (1991).

39. **(C)** Is the ADEQ unaware that a heavily traveled state highway is within a few hundred feet of the proposed emission source? How can the ADEQ allow the traveling public to be exposed to the proposed levels of cyanide and other pollutants, particularly if they are unaware of said hazard? Is ADEQ aware that the proposed operation intends to ask that the highway be closed twice a week during blasting? I was told that the earth shock from the blasting would be no stronger than a 4.0 earthquake! What does that say about the potential hazard to those of us who LIVE HERE, if the mine is so concerned about the effects of the blasting on the traveling public!!

(R) Clearly the most dangerous area during a blast are the roadways in the vicinity of the blast. These zones will be closed to the public for their protection. With regard to cyanide, see previous response. The other pollutant concentrations will also be below the ambient standards.

40. **(C)** In reading the application, I do note that the application (attachment B, part III, paragraphs B and C) specifies that HCN gas and NaCN dust shall not exceed 0.3 ppmv and 140 micrograms per cubic meter, respectively, at any occupied place beyond the mine's premises. I also note that this level is AVERAGED over an 8 hour period. This is not acceptable. This means that much higher levels would be tolerated for shorter periods, as long as the AVERAGE was within the specified limits.

(R) The maximum ambient levels and averaging times are codified in A.A.C. R18-2-730.J and 730.K. The Department has no authority to alter these requirements in this permit.

41. **(C)** I would also like to have copies of whatever reports that have been submitted to the ADEQ detailing what specific gasses will be emitted by the operation of the HCN solution on the ore specific to the proposed Yarnell Mine operation. Every mine ore is distinctive, and I would assume that the ADEQ would demand that the applicant submit such a report. It is simply not adequate to apply for a 'blanket' permit allowing potentially lethal, but unknown and unspecified, compounds to be emitted. Here I am speaking of poisonous metallic, non-metallic, and organic gaseous compounds, many of which are potentially cancer causing, which might be emitted during the cyanide leach process. Only by testing the specific ore can this data be determined. I would think that this is a natural part of the job which the ADEQ should be doing for the citizens of Arizona in general, and the residents of Yarnell and Glen Ilah, particularly, as well as the traveling public on highway 89. If such a report is available, I would like to have a copy for future reference. If such a document is not available, it is incumbent upon the ADEQ to obtain same, if for no reason than to insure against potentially extensive future liability, should this application be granted.

(R) The mechanisms that would cause emissions of ore material particulate and gases during the proposed heap leaching process at the Yarnell mine site are limited to three possibilities: (1) release of particulate from mining and ore handling operations, (2) emission of HCN gas from leaching operations, and (3) emission of gases and particulate from smelting operations. There are no other modes of airborne release of materials from the proposed leaching operations.

Release of particulates from mining and material handling operations at the site will be controlled by standard dust suppression methods, including treating road surfaces with water, utilizing water sprays at the ore crushing plant, and adding water to the heap surface as part of the leaching operations. Emissions of HCN will be controlled by maintaining the pH of the process solution at or above 10.5 to reduce fugitive emissions of HCN from the leach pad and processing circuit. Particulate emissions from the dorè furnace and carbon kiln will be collected by a baghouse in the Adsorption, Desorption and Refining (ADR) Plant. All emissions are to be within specified limits and monitored as outlined in the permit.

The proportion of particulates that would contain metals of concern for human health is very low. Representative samples of mineralized material from the hanging wall, ore zone, and foot wall areas of the mine have been evaluated with trace element geochemistry and whole rock elemental analyses. These analyses indicate that the proportion of metals of concern such as arsenic, cadmium, chromium, and lead are in the 1 to 100 parts per million range as a component of particulate matter that would be generated from the proposed operations. The results of these analyses are considered typical of the deposit.

42. **(C)** In the tabulation of the application frequency for spraying unpaved roads, no provision is made for freezing weather. The Office of the Arizona State Mine Inspector has a problem with spraying roads in freezing weather if doing so renders a dangerous surface.

(R) This is a point well taken; the permit will reflect this concern.

43. **(C)** The State Mine Inspector finds a limitation of operating hours in a permit as unacceptable. The right to limit emissions to a certain specified amount is recognized; however, if a company is willing to invest in better technology to limit annual emissions, they should be allowed to operate 24 hours a day 365 days a year if they so desire. The State Mine Inspector views the imposition of a limitation on hours a permittee can operate as a dangerous president that could be used to render future projects uneconomic. ADEQ should set emission standards, but not operating hours.

(R) On an air emissions/air quality basis, the commentor is correct. Should YMC be willing to invest in technology that results in further control of its air emissions, it would be possible to increase production rates and operating schedule to a theoretical maximum of 24-hours per day, 365 days per year as long as all applicable air quality regulations and standards would continue to be met.

The emissions inventory and modeling analysis for the Yarnell Project are based upon the activity rates and mining schedule included in the current Mining Plan of Operations. At these activity levels and operating schedule that have been proposed by YMC for its operation, YMC has demonstrated that applicable air quality regulations and standards will be met. ADEQ has incorporated these activity levels and operating schedule into the air permit as enforceable conditions to ensure ongoing compliance with applicable regulations and standards. Since most of the emissions are fugitives which are difficult to monitor in terms of mass emissions, the only viable, measurable and enforceable limitation that will assure compliance is the limit on the activity rates and schedule. YMC may propose a modification to its permit should it wish to change its method of controls, increase production, alter its operating schedule, etc. Such a modification would be granted only if ongoing compliance with all applicable regulations and standards were demonstrated. The applicant has proposed a project with the air emission controls they intend to employ.

44. **(C)** Where are they going to store the chemicals they use? Will this be monitored so that they are stored safely?

(R) The location of the reagent storage is in the southeast corner of the property next to the barren solution pond. Referring to the draft permit, Attachment "B", Section IV.C.5, the sodium cyanide on the premises shall be stored in metal flow bins, double lined boxes, and/or is delivered as an aqueous solution). This will be checked during all inspections of the mine.

45. **(C)** What will be the effect of the blasting on the roads, especially the Yarnell Hill which has large rocks that look like they're barely staying in place above the roadway? What if the blasting jars these rocks loose and they fall down the hill, into the roadway, and killing people? We are very concerned about the effects of blasting.

Blasting is shattering to the peace and quiet of the neighborhood and to people's nerves. A schedule of when the blasting takes place should be sent to all within earshot range. We should be notified of any changes in the schedule before the blasting takes place.

(R) This is certainly a valid concern; however, it is not an air quality issue. YMC's Mining Plan of Operation describes the specific design elements and precautions that YMC will take to control rock

movement, ground vibration, and air blast from proposed blasting operations. It also discusses methods to stop traffic on Highway 89 during certain aspects of the blasting operation as a public safeguard. The potential effects that blasting operations may have on areas adjacent to the mine site, including public roadways, are being addressed in the Environmental Impact Statement being prepared by the Bureau of Land Management (BLM). Please contact Ms. Connie Stone at (602) 580-5517 with questions regarding these issues.

In accordance with YMC's Mining Plan of Operation, weekly schedules for highway closures will be submitted to the Arizona Department of Transportation. These schedules will be made readily available to the public.

46. **(C)** Why can't a citizens council be appointed to protect the citizens of this area? Other states are doing this; why can't Arizona do the same?

(R) There is no reason that the local citizens could not form a "watch dog" committee. ADEQ would certainly be willing to assist such a citizens group with training. We also encourage residents to promptly report complaints to us at 1 (800) 234-5677, ext 2339. Some citizens may like to attend the Arizona opacity school and become certified opacity readers.

47. **(C)** It was frequently urged that ADEQ conduct unannounced inspection at least every three months. Further, there was much skepticism with regard to the concept of the mine being self-monitoring.

(R) AQD inspectors always conduct unannounced inspections, unless the inspection is associated with a performance test. ADEQ cannot commit to an inspection every three months. Inspections may be more frequent or less depending on developments after the mine begins operations. Since much of the monitoring is performed through recordkeeping and self-reporting of malfunctions and permit deviations that lead to excess emissions, the field inspectors examine the logs when they are there (unannounced) to be sure that they are proper and consistent with permit conditions. The reports which are sent to the Compliance Section of AQD are reviewed, and if a problem is apparent, the inspector is alerted. Public reports of any apparent problem, e.g., excess dust, water trucks not following the permitted schedule, etc. will be fully investigated.

ABBREVIATIONS

µg ..... micro grams
A.A.C. ..... Arizona Administrative Code
AAAQG ..... Arizona Ambient Air Quality Guidelines
ADEQ ..... Arizona Department of Environmental Quality
ADR ..... Adsorption, Desorption and Refining
APP ..... Aquifer Protection Permit
AQD ..... Air Quality Division
A.R.S. ..... Arizona Revised Statutes
BACT ..... Best Available Control Technology
BLM ..... Bureau of Land Management
CFR ..... Code of Federal Regulations
CO ..... carbon monoxide
E ..... maximum allowable particulate emission rate, pounds per hour
EIS ..... Environmental Impact Statement
ft ..... foot, feet
HC ..... hydrocarbons
HCN ..... hydrogen cyanide
Hg ..... mercury
m ..... meter, meters
$MgCl_2$ ..... magnesium chloride
MMBtu ..... million British thermal units
NAAQS ..... National Ambient Air Quality Standards
NaCN ..... sodium cyanide
NEPA ..... National Environmental Policy Act
NO ..... nitrogen oxide
NO_2 ..... nitrogen dioxide
NO_x ..... oxides of nitrogen
Pb ..... lead
PM_{10} ..... particulate matter with an aerodynamic diameter of less than 10 microns
ppmv ..... parts per million by volume
PSD ..... Prevention of Significant Deterioration
PSNSRU ..... Permit Section/New Source Review Unit
Q ..... heat input, million BTU per hour
R18 ..... Title 18
SO_2 ..... sulfur dioxide
TSP ..... Total Suspended Particulate
USEPA, EPA ..... United States Environmental Protection Agency
VOC ..... volatile organic compounds
YMC ..... Yarnell Mining Company